HISTORIC MASONRY RESTORATION

Through the Eyes of a Master Stonemason

By Mark Mendel

There was a building boom here in Berkshire County, Massachusetts, during the 1780s and 1790s. Many hundreds of houses survive. They are timber framed, wide plank sheathed, and clapboarded with the cedar, pine, and chestnut that was plentiful in the area. These spare, elegant, farmhouses were built without engineers, architects, or building codes, yet here they are after 225 years, their fireplaces brightly burning, warming a 9th generation of New Englanders. This amazing architectural accumulation makes up the core fabric that we recognize as New England. Because these houses are still lived in, because they are not historical theme parks, they serve to bind the past and the present together as a single living thing.

Photo courtesy of Paul Rocheleau

Restored 18th century fireplace and bake oven. Marble cheeks, brick, granite hearthstones.

18th century fireplace and bake oven before and during restoration.

18th century stage coach shop before and after restoration.

Photo courtesy of Paul Rocheleau

As builders and design professionals we are charged with the protection of this legacy. Our challenge is to make these houses last another 225 years, while at the same time bringing them into the 21st century. We must introduce modern systems of energy and information, as well as contemporary codes for fire, safety, and energy efficiency… all the while maintaining the historical integrity of these architectural treasures.

18th century village house. Grade has gone up and sills are rotted.

Restoration must begin with an understanding of the technology and materials that were common to the period. These techniques, tools, and materials were the result of hundreds if not thousands of years of development by trial and error. These houses were hardly "primitive" in the sense of crude. As the poet Gary Snyder has written, "What we call the primitive is a mature system with deep capacities for stability and protection built into it." Structures were "field tested" over long years of close observation. Results were rarely written down and even more rarely disseminated to newer builders. There exists no owner's manual for the 18th century house. Instead, knowledge was passed down over generations from craftsman to craftsman within a master/apprentice tradition. Structures that evolved through this slow and cautious process were uniquely, even brilliantly, suited to long-term survival. There is a system at work here, an integrated, holistic system. Understanding this system is the key to both the restoration and preservation process. Changes made without understanding can cause the system to break down. Look for example at lime plaster laid across wooden lathes. The wet plaster keys, or wraps around each piece of lathe and "grabs a hold of it." This simple mechanism has supported enormous plaster ceiling loads for hundreds of years without failure. Now introduce insulation. The insulation is put in tightly in a way that presses against the back of the lathes. When the mason pushes the plaster with his trowel, the insulation pushes back. So there is no keying and the ceiling falls down. Good system, just not understood.

18th century village house showing original stones "sunken" below grade.

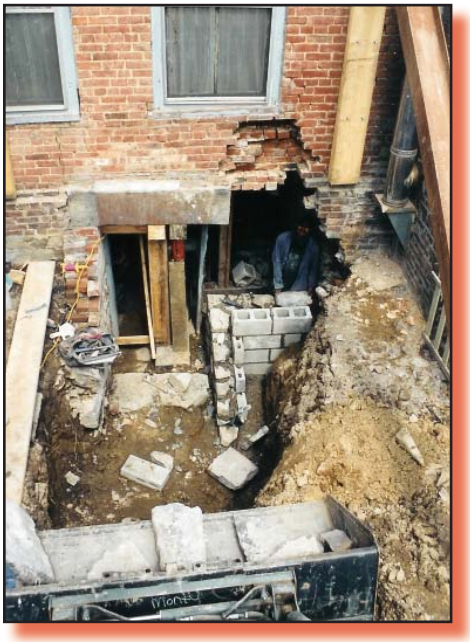
If the insulation was stuffed in AFTER the plasterwork there would be no problem.

Breakdowns occur in three areas:

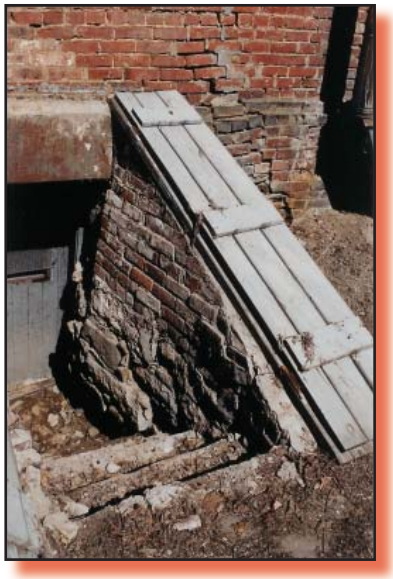
1. Neglect of maintenance. Roofs and gutters that fail are, notoriously, the point of the wedge of structural breakdown. Good maintenance nourishes survival.

2. Changes external to the system, changes that could not have been anticipated by the builders. 18th Century builders of brick town houses did not dream of pile drivers working nearby, or of subway trains constantly shaking the ground beneath their footings.

3. And finally, problems occur when the restoration efforts are outside the system of the architecture. If the engineer says, "It's too old, it can't be saved, tear it down," if the builder says "Throw out those old doors and get new ones," the legacy is in jeopardy. It's time for a more sympathetic team. We are all familiar with concept of "load bearing". May I suggest a new concept: Historic load bearing. Incorrect materials and techniques introduced into historic architecture fail. They fail to carry the historic load and we have an aesthetic collapse.



Jack under lintel. Wall is rebuilt on concrete footing.



Water blows out bulkhead wall. Lintel drops. Wall sags.

BRICK

18th and early 19th century bricks were hand made locally, if not on site. In New England, bricks were typically 7 to 8 inches long, 1-½ to 2 inches high and 4 inches wide. They were thinner than modern brick, which are typically 2-⅝ inches high. Bricks were not perfectly copacetic as are today's industrially produced wire cut brick, but had a rather wide range of unique shapes and colors. With their shapeliness and no-two-bricks-alike qualities, they resembled the product of the potter's kiln. They had a soft beauty that contemporary large-scale manufacturers cannot match. Even if bricks of modern manufacture are sawn or special ordered to size, their monotonous flatness stands out as a glaring patch in any restoration.

Detail showing original brick coursing "off" by one course.

The brick making process began with wet clay hand pushed into wooden molds. The molded bricks were air dried, then stacked into some variety of dome shape to form a kiln. A roaring wood fire in the kiln fired the brick. Bricks nearest the fire were the hardest and least porous. These "hard fired" brick were carefully selected and sold at a premium as "face brick". Face brick were hard enough to take the New England winter. Softer fired

brick were used where there was no weather exposure, for interior chimneys, basement walls etc. 18th century builders specified hard burned brick for facings (exteriors) and soft "Salmon brick", so called for their light orange color, for interior partition walls. In our highly quantified world of ASTM standards, these characteristics of hard and soft brick are lost knowledge. A wrecking ball knocks down an old factory building. The bricks are gathered, the soft mixed with the hard, palletized, and sold under the label "used brick". As indiscriminately as they are sold, so they are laid, the soft mixed with the hard. The soft bricks absorb rainwater, freeze, and spall away.

Rules to follow:

- Save and reuse original materials when in good condition. The addition of a garage door out back might generate several hundred original face bricks that might be used later to repair a facade.
- The old brick had a top side and a bottom. The top side of the wooden mold was open to the air and this side was finished flatter. Lay this side up. The side that was down against the bottom of the wooden mold was rougher and slightly convex. Lay this side down. This top/bottom placement or misplacement can affect the finished brickwork. Instead of a smooth vertical corner or jamb, laying the bricks upside or mixed can give even originals a herky jerky look.

Finished job with original mistakes left in.

Left to right: hand made 18th century brick, restoration brick, new wire cut brick.

- Be aware that persons with a discerning eye for valuable historic building parts will rarely seek employment in the demolition trade.
- Never sandblast brick in an attempt to clean it. Blast with baking soda which is less abrasive.
- Standard brick ties are made for tying a veneer wall to wooden or metal studs or a concrete wall. When relaying a brick face wall that has separated from the wythe (wall) behind it use a spiral type helix type tie. These are sometimes called restoration ties.
- Allow *time* in the planning process to source out matching brick. If substituting new restoration brick, use brick that is *manufactured* in the old way, not just new brick that has been decorated to look "antique". Yes, there are companies that still press clay into wooden molds as in the old days. They produce beautiful brick that meet modern specs but match antique brick perfectly. They can also do a great job of custom matching site specific original brick. Allow time in planning. These companies may not be as fast with an order, but the results cannot be compared with off the shelf brick. Three companies that make these brick are Vermont Brick, Morin Brick in Maine, and Old Carolina Brick in North Carolina.

STONE

As with brick, save and use original materials when possible. But with stone, we quite often see original stone relayed improperly. The old masons said, "Lay the stone the way it came out of the ground." That is with the bed of the stone, the grain, parallel to the ground. Now that I'm an old mason, I say it too. Don't stand the grain up. Stone laid grain up or perpendicular to the ground is exposing the stone to water infiltration.

This rule often comes into play when a structure is moved from an old stone foundation to a new concrete foundation. A concrete stone shelf is provided, usually 4-inches which is adequate for brick but not for stone (6 to 8 inches should be the width of the shelf). Masons take the original load bearing stone and set it on the shelf with its grain up, in the manner of 1950's veneer. This is the quick and dirty way of making the original stones fit a shelf. For proper restoration, the original stones must be back sawn to fit the shelf and laid in the original manner with the original faces facing out.

MORTAR

In the last six or eight years there has been a revolution in the restoration world - a return to true lime mortars. We have always known that characteristics of the setting materials must be compatible with the brick and stone. When soft brick is laid or repointed with hard mortar, the brick eventually suffers. For years we fiddled with hydrated lime in attempts to trick Portland cement into looking and behaving like the old stuff. Now, thanks to the pioneering work by the Scottish Lime Council in Edinburgh and American revolutionaries like Jimmy Price of Virginia Lime Works, we have the information and the materials available for proper mortars that will not harm our old buildings. The new rule is simple. If it was originally built with lime mortars and plasters, it should be maintained and restored with the same. Where Portland mortars were used over the years, this material needs to be carefully removed and the work redone with lime.

Jeff Price's article in Structure magazine, "Yes, it does matter what mortar you use."

1803 townhouse. Marble entry in disrepair. Note concrete sidewalk has risen 8" from original grade burying bottom step

(STRUCTURE May 2004) is a wonderful introduction to this interesting and vast subject. Don't be afraid of the lime mortar that has survived thousands of years.

Here are a few examples of problems to consider:

1. Wooden sills rotting from sustained moisture.

The Sills of old houses were typically resting, 16 to 20 inches above grade, high and dry upon a brick or stone foundation wall or upon split granite "set up" stones. Now we see old houses that appear to have sunk into the ground with their bottom most clapboards at grade. In the 19th century, it became fashionable to surround a house with a necklace of shrubs. As the decades passed, the annual fallen and composted leaves caused gradual rise in the grade. The house never sank, but it might as well have for now the sills lie beneath the snow. The solution, after the sills have been repaired, is to remove the shrubbery and return to the original grade that must be pitched to drain away from the house.

2. Bulkhead collapses and lintel above drops, causing brick veneer face to split and sag.

Note second floor windows sagged out-of square. Examination shows that, with no drainage provided for gutters, water ran down the bulkhead wall, froze and pushed it out. When we began this repair we had a surprise. All the settling problems were confined to the basement and the lower first story. So, what caused those sagging second floor window casings? A drunken mason in 1825? That would be my guess.

When his brickwork came around the house, he was one course off. That's about 2 ¾ inches. Hard to hide, but also hard to fix. So somebody decided to leave the mistake. Just have the carpenters make crooked windows. Make them about 2-¾ inches out of square. We decided not to correct this situation… it has been structurally sound for 150 or so years.

3. House catches fire because chimney settling allows hot coal to work down through rubble masonry and ignite beam.

This little coal smoldered for a week on basement drafts, and finally lit up the beam and part of the house. A solution for this hazard is to pour a hidden concrete slab to seal off the fireplace and hearth from wood. Everything still looks original, even the crow's mouth joints.

4. Original Chimney blown apart by Concrete flue liner.

A poured concrete liner is a quick, relatively inexpensive and fireproof method for bringing an unlined chimney up to code. Or is it? The hard and impervious liner is a change to a natural breathing system, a flowing system where water absorption was quickly evaporated by the warmer air in the chimney. With the introduction of the concrete liner, water trapped between the bricks and the liner froze, and when it expanded the soft bricks rather than the hard liner blew apart. To the cost of the liner add the cost of completely rebuilding the chimney and installing a proper terra cotta liner. In this case, the shortcut costs more.

5. Building Code requires the use of lab tested high temp refractory cement for setting flues.

Lab condition tests show this water soluble cement takes a hard, fireproof, durable set at about 400 degrees F. Real life conditions: the house has five chimneys with nine fireplaces. The Owner only ever uses one fireplace. The flues at the top of the chimney he does use are 42 feet away from fire, and the chimney is constantly chilled by raw New England winds. Even with a hot fire, the heat doesn't reach the uppermost flues at a temperature sufficient to harden the cement. Result: Over a year or so, the rainwater washes away the majority of the refractory cement. Solution: use RF cement to meet code and go over the outside of all joints with a heavy layer of regular mortar.

6. Lab tests determine fireplaces to be inefficient.

Engineers recommend elimination of fireplaces. Real life condition: Hundreds of clients over decades declare unanimous love for their fireplaces. Solution: Determination of aggregate efficiency must include spiritual and aesthetic efficiency.

CONCLUSION

We work hard to return these old homes to a working system of built-in stability and self protection. Correct materials. Sympathetic craftsmen. To what end? What is the value of all this effort?

Every day we look out at the world through mass produced plate glass. We have become so accustomed to its relentless flatness and sameness that we register this vision as a kind of truth. Stand for a minute in an 18th century parlor and gaze out the window. The sash of divided lights, each a small 6 by 8 inch piece of glass, allows us to see the world as others once saw it. The glass is thick, and the thickness varies. It is full of imperfections, specs, and whorls that show the last movement of the liquid "gather" before it hardened into glass. Seeing through the old glass, there is a real depth and a shining clarity… so much so that this new/old/new vision of the world gives a bit of a jolt. It is this clear and shining vision that we work to preserve.▪

1803 townhouse with marble repaired and relayed on proper foundation. Entry restored to single doorway. Concrete sidewalk replaced with 19th century brick pavers.

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